STATEMENT OF BASIS
SOUTHERN PORTION OF THE SOUTH TNT GROUNDWATER BASIN AND ASSOCIATED ENVIRONS
VOLUNTEER ARMY AMMUNTION PLANT
CHATTANOOGA, TENNESSEE
12 December 2005

US Army Corps Of Engineers Mobile District

PURPOSE OF STATEMENT OF BASIS

This Statement of Basis has been developed to inform the public and solicit comments on the proposed corrective measure for restoration of a portion of sitewide groundwater (Site VAAP-35; Area of Concern [AOC] 6) at the former Volunteer Army Ammunition Plant (VOAAP). The portion of VOAAP addressed by this Statement of Basis is shown in Figure 1. The Installation Restoration Program team, consisting of the U.S. Army, the U.S. Environmental Protection Agency (EPA) Region 4, and the State of Tennessee Department of Environment and Conservation (TDEC), have determined that the proposed corrective measure is protective of human health and the environment. The Army team includes the U.S. Army Environmental Center, the U.S Army Base Realignment and Closure Division, the U.S. Army Corps of Engineers, and various environmental consulting firms.

Brief Site Description

The groundwater study area includes groundwater underlying the buffer and support areas south and east of the TNT process area, the southern fringe of the TNT Manufacturing Valley, and the buffer area west of the Old Magazine Areas. The property is located within the southern portion of the South TNT Groundwater Basin and includes the following environmental sites:

- Salvage Yard
- Rail Car Loading Area
- Drum Storage Area
- Warehouse Area and Pesticide Storage/ Mixing Area
- Army Reserve Parcel
- Southern Rail Area
- Offsite Areas

This Statement of Basis identifies the proposed corrective measure for groundwater, explains the rationale for its selection, describes the remedial alternatives evaluated, solicits public review and comment on the remedial alternatives, and provides information as to how the public can be involved in the corrective measure selection process. A glossary, which defines some of the technical terms contained herein, is included in this document.

Prior to finalization of the proposed corrective measure, the Installation Restoration Program team is offering the public an opportunity to comment on the proposed corrective measure. At any time during the public comment period, comments may be submitted as described in the "How Do You Participate" section of this Statement of Basis. Upon closure of the comment period, the Installation Restoration Program team will address all comments and issues raised and will determine if there is a need to modify the proposed corrective measure prior to its implementation.

The Proposed Cleanup Corrective Measure

Institutional controls that prevent access to groundwater for any purpose, including but not limited to pumping such that the upgradient plumes may be accelerated in a southerly direction, to include:

- Appropriate onsite future land use (e.g., restrictions on groundwater wells).
- Periodic review to ensure that any restrictions remain in place.

Monitored natural attenuation criteria will be analyzed for a period of two years to confirm that natural attenuation is continuing. Periodic sampling and analysis of groundwater for explosives concentrations that exceed the residential groundwater cleanup criteria will assess contaminant reductions in groundwater. Monitoring will continue periodically until contaminant levels fall below unrestricted use criteria, which is estimated to be approximately 30 years.

WHY IS CLEANUP NEEDED?

The results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation indicated that explosives are present in onsite and offsite groundwater at concentrations that could be harmful to human health.

In accordance with RCRA Section 7004(b), this Statement of Basis summarizes the proposed remedy for VOAAP groundwater. For detailed information, consult the VOAAP Sitewide Groundwater RFI/Focused CMS Report, which is available for review at the Chattanooga-Hamilton County Bicentennial Library, 1001 Broad Street, Chattanooga, TN 37402 (See “How Do You Participate”).

HOW DO YOU PARTICIPATE?

The Installation Restoration Program team solicits public review and comment on this Statement of Basis. This comment period will be conducted prior to finalization of the proposed remedy as a selected corrective measure. The comment period for this Statement of Basis is from December 12, 2005, to January 12, 2006. If requested during the comment period, the Installation Restoration Program team will hold a public meeting to respond to any oral comments or questions regarding the proposed corrective measure. To request a hearing or provide comments, call or write to the following persons within the comment period:

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The U.S EPA Final Administrative Order (Docket No. RCRA-04-2001-02), this Statement of Basis, the Focused Corrective Measures Study dated November 2005, and the associated administrative file including the RCRA Facility Investigation/ Corrective Measures Study Report (which is the foundation for this Statement of Basis) and subsequent reports will be available to the public for viewing and copying at:

Chattanooga-Hamilton County
Bicentennial Library
1001 Broad Street
Chattanooga, TN 37402

To request further information, you may contact one of the following people (as outlined above): Mr. Scott Bolton, Mr. Tim Woolheater, or Ms. Nancy Boisvert.

FACILITY DESCRIPTION

VOAAP was a government-owned and contractor-operated facility for the production and storage of 2,4,6-TNT. The facility was built between 1942 and 1943 in support of World War II and subsequently operated during the Korean and Vietnam wars. VOAAP remained in standby status from 1977 when TNT production ceased until 1999 when it was declared excess by the Army. Following the declaration of excess, property transfers and sales were initiated. The bulk of the property at VOAAP and all of the property that is the subject of this Statement of Basis have been transferred to the City of Chattanooga and Hamilton County with the stipulation that the property will be used for industrial reuse.

SITE DESCRIPTION AND HISTORY

The site includes groundwater underlying the buffer and support areas south and east of the TNT process area, the southern fringe of the TNT Manufacturing Valley, and the buffer area west of the Old Magazine Areas. The site is in the southern portion of the South TNT Groundwater Basin and includes the following environmental sites (with site number and AOC number or solid waste management unit [SWMU] number, as applicable):

- Salvage Yard (VAAP-32, SWMU 11)
- Rail Car Loading Area (VOAAP 32, AOC-9)
- Drum Storage Area (VOAAP 32, AOC-9)
- Warehouse Area and Pesticide Storage/ Mixing Area (VAAP-31, SWMU 10)
- Army Reserve Parcel
- Southern Rail Area
- Offsite Areas

The soil, sediment and surface water for these sites have been investigated and have or will receive regulatory no-further-action in the near future. Groundwater has low levels of explosives that have migrated from the former TNT process areas.

This Statement of Basis includes all groundwater that lies in the shaded area shown on Figure 1. Groundwater to the east of this shaded area has already been addressed with no-further-action required. Groundwater to the north and west of this shaded area is in the former TNT process areas in the North TNT Groundwater Basin and the northern portion of the South TNT Groundwater Basin, and it will be addressed under a separate Statement of Basis.

Several facility-wide groundwater investigations have been conducted between 1981 to the present. Groundwater remedial activities have not been implemented. Previous environmental studies of groundwater are summarized below.

1981 Exploratory Survey. Groundwater samples were collected in 1981 by MCI Consulting Engineers, Inc. TNT and DNT were detected above groundwater guidance criteria.

1983 Confirmatory Survey. Groundwater samples were collected in 1983 by Battelle, Inc., from monitoring wells. TNT and DNT were detected above groundwater guidance criteria.

1986 Remedial Investigation. Groundwater samples were collected in 1986 by Roy F. Weston, Inc., from monitoring wells. TNT and DNT were detected above groundwater guidance criteria.

1994 Site Investigation. Groundwater samples were collected in 1994 by IT Corporation from monitoring wells. TNT and DNT were detected above groundwater guidance criteria.

2000 Quarterly Sampling. Groundwater samples were collected on a quarterly basis in 2000 from monitoring wells. TNT and DNT were detected above groundwater guidance criteria.

2004 RCRA Facility Investigation/Corrective Measures Study for the North and South TNT Manufacturing Valley Groundwater. Additional residuum and bedrock monitoring wells were installed to further define the nature and extent of groundwater contamination. As part of the continuing monitoring program, groundwater samples were collected starting in the Spring of 2003. Additional samples have been collected semi-annually in the Spring and Fall of 2004 and 2005. TNT and DNT were detected above groundwater guidance criteria.

SUMMARY OF SITE RISK

An installation-wide human health risk assessment was conducted in 1994 and revised in 2002 to estimate the health risks associated with the groundwater contamination. The risk assessment was performed in accordance with risk management decision processes established by the U.S. EPA, TDEC, and the U.S. Army Corps of Engineers. The risk evaluation for human health was updated and summarized in the RCRA Facility Investigation/Corrective Measures Study for Groundwater.

Unacceptable human health risk exists from prolonged ingestion of contaminants in groundwater. The risk assessment considered groundwater users for the intended future use of groundwater. Utilizing the methods and equations used in development of the U.S. EPA Region 9 Preliminary Remediation Goals, groundwater cleanup objectives were developed by using standard exposure parameters. Residential use of the land is not expected; however, potential future onsite residents were considered in the risk assessment for completeness. Potential adverse risk is possible for both onsite and offsite residents. DNT (mixture) and 2-nitrotoluene are the contaminants of concern for which groundwater cleanup objectives were established. Currently there is no unacceptable risk to onsite workers; however, pumping of groundwater could increase risk to unacceptable levels.

WHAT ARE THE CLEANUP OBJECTIVES AND LEVELS?

The purpose of the corrective measure identified herein is twofold: to prevent ingestion of aquifer

groundwater containing carcinogens in excess of the U.S. EPA Region 9 Preliminary Remediation Goals for hypothetical onsite and offsite evaluations, and to prevent pumping of groundwater that may draw the contaminant plume from other areas. Table 1 lists the contaminants of concern present in sitewide groundwater that are addressed as part of this proposed corrective measure. The first column lists the maximum concentrations detected in residuum and bedrock groundwater during Spring 2003, Fall 2004, and Spring 2005; and the adjacent columns present the established groundwater cleanup objectives. Groundwater monitoring will be conducted to verify that natural attenuation is continuing to reduce contaminant levels.

Table 1 – Groundwater Cleanup Objectives

Groundwater Chemicals of Concern (contaminants of concern)	Maximum Detected Concentration (ug/L)	Residential Groundwater Cleanup Objective (ug/L)	Onsite MNA Groundwater Cleanup Objective (ug/L)
DNT (Mixture)	2.64	0.099	4.208
2-Nitrotoluene	4.5	0.049	12.44
4-Nitrotoluene	4.8	0.659	168.3

ug/L – microgram per liter
MNA – monitored natural attenuation
Onsite MNA cleanup objectives have been met as of this date. Two more years of monitoring are planned for verification that cleanup objectives remain met.

CLEANUP ALTERNATIVES FOR GROUNDWATER

Cleanup alternatives are different combinations of plans, technologies, and processes to restrict access, contain, remove, and treat contamination in order to protect public health and the environment. The cleanup alternatives considered for groundwater are summarized below.

Alternative 1 No-Action. The No-Action alternative serves as a baseline consideration or addresses sites that do not require active remediation, and, under Department of Defense guidelines, it is required to be evaluated. This alternative assumes that no corrective action would occur; no remedy would be implemented. No institutional controls would be implemented to prevent use of groundwater. Natural attenuation would eventually reduce low concentrations of contaminants in groundwater to acceptable levels, but the progress of attenuation would not be monitored.

Alternative 2 Institutional Controls. This alternative is comprised of institutional controls, such as deed restrictions, Notice of Land Use Restrictions per Tennessee Codes Annotated 68-212-225, and administration of State rules by local authorities to prevent installation or use of groundwater wells. The controls will also prevent pumping of groundwater until cleanup goals have been met in both the south and north portions of VOAAP to ensure that the northern portion of the plume is not drawn to the south. Periodic review of the institutional controls will be implemented as per the institutional control design to verify that the remedy remains protective. This alternative does not include sampling and analysis of groundwater.

Alternative 3 Institutional Controls and Monitored Natural Attenuation. This alternative is comprised of the implementation of institutional controls as stated in Alternative 2 and the monitoring of groundwater and offsite springs. MNA criteria (as described in the Focused Corrective Measures Study) will be monitored for a period of two years to confirm that natural attenuation is continuing. Periodic sampling and analysis of groundwater for explosives concentrations that exceed the residential groundwater cleanup criteria will assess contaminant reductions in groundwater. Monitoring will continue periodically until contaminant levels fall below unrestricted use criteria, which is estimated to be approximately 30 years.

EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

Each cleanup alternative was evaluated to determine how the potential corrective measure would comply with the four threshold criteria for corrective measures. The four threshold criteria are:

- Protect human health and the environment
- Attain media cleanup objectives set by the implementing agency
- Control the source of releases
- Comply with any applicable standards for management of wastes.

Balancing criteria for corrective measures are used to focus the selection of a remedial alternative on a final corrective measure and consider practical, technical, and economic factors. The five balancing criteria are:

- Long term reliability and effectiveness
- Reduction in the toxicity, mobility, or volume of wastes
- Short-term effectiveness
- Implementability
- Cost.

Alternatives 2 and 3 satisfy the four threshold criteria and the middle three balancing criteria. Costs for Alternative 3 are approximately 14 percent higher than Alternative 2 because Alternative 3 would require long-term monitoring to ensure its effectiveness. Alternative 3 was selected as the preferred alternative because it is the most protective of human health, it ensures groundwater concentrations continue to decrease and are not impacted by the northern plume, and it allows for determination of when all cleanup objectives have been met. Table 2 contains the comparison analysis of the three alternatives.

PROPOSED REMEDY

Alternative 3 is the proposed remedy for implementation and consists of institutional controls as stated in Alternative 2 and the monitoring of groundwater and offsite springs. The Army will conduct approximately two years of MNA sampling and approximately 30 years of periodic long-term monitoring and reporting.

The portion of the remedy that includes institutional controls will be further described in the Groundwater Corrective Measures Implementation Work Plan, which will be submitted in accordance with the Corrective Action Management Plan schedule. The institutional control component of the Corrective Measures Implementation Work Plan shall address all required implementation and maintenance actions.

The Army is responsible for implementing, maintaining, reporting on, and enforcing the institutional controls. The Army intends to assign certain of these responsibilities to the transferee and other parties. However, the Army retains ultimate responsibility for corrective measure integrity. The institutional controls will be maintained until the concentrations of hazardous substances in the groundwater in both the north and south areas of VOAAP are at such levels to allow for unrestricted use and exposure.

WHAT IMPACTS WOULD THE CLEANUP HAVE ON THE LOCAL COMMUNITY?

The selected alternative does not involve any major construction activity, and it does not pose any threat to local communities. It does, however, involve restrictions on groundwater use over the long term.

WHY DOES THE INSTALLATION RESTORATION PARTERNING TEAM RECOMMEND THIS CORRECTIVE MEASURE?

The Installation Restoration Program team recommends the proposed corrective measure because it is the most cost effective, easily implemented, and reliable remedy available for groundwater remediation within the study area. The proposed corrective measure meets the four threshold criteria for corrective measures and best balances the practical, technical, and economic factors that must be considered.

NEXT STEPS

Following the public comment period, the Installation Restoration Program team will review all comments regarding this Statement of Basis to determine if the proposed corrective measure requires modification prior to implementation. If the proposed corrective measure is determined to be appropriate for implementation, then the final corrective measure will be implemented as follows:

1) Following approval of the Final Statement of Basis (after the public comment period), the Army shall prepare and submit to U.S. EPA and TDEC for review and approval a Corrective Measure Implementation Work Plan in accordance with the Corrective Action Management Plan schedule. The plan will include

a description of the groundwater remedial activities, which will include groundwater monitoring and reporting, as well as how the institutional controls will be monitored.

2) The Corrective Measure Implementation Work Plan will be implemented.

GLOSSARY

Area of Concern (AOC) – Areas identified during the course of investigation, which may have been contaminated by operations at the site.

Chemicals (contaminants) of Concern – Chemicals present in groundwater at the site at levels that may be considered harmful to human health or the environment.

DNT – Dinitrotoluene, a nitroaromatic explosive compound manufactured in the process of making TNT or found as a byproduct of the degradation of TNT.

Institutional Controls – Non-engineering measures designed to prevent or limit exposure to hazardous substances left in place at a site, or assure effectiveness of the chosen remedy. Institutional controls are usually but not always legal controls such as easements, restrictive covenants, and zoning ordinances.

Maximum Contaminant Level (MCL) – the highest level of a contaminant allowed in drinking water. MCLs are enforceable standards that are set as close as possible to maximum contaminant level goals, which are non-enforceable health goals at which no known or anticipated adverse effects occur.

Monitored Natural Attenuation (MNA) – The U.S. EPA defines MNA as a cleanup approach based on understanding and documenting the naturally occurring processes at a site to achieve site-specific corrective measure objectives within a reasonable time frame. Natural attenuation processes include biological processes such as aerobic and anaerobic biodegradation; chemical degradation via oxidation/reduction; plant uptake (if applicable); and physical phenomena such as advection, dispersion, dilution, diffusion, and sorption.

Preliminary Remedial Goals – A conservative set of comparison values determined by U.S. EPA against which site data are screened to evaluate the presence of chemicals of potential concern. The values are based on a one in one million (1/1,000,000) cancer threshold or a non-cancer hazard index of 1.0 for a potential future resident.

Residuum – soil that is derived from the weathering of rock.

Resource Conservation and Recovery Act (RCRA) Corrective Measures Study – A study conducted under the requirements of RCRA to determine the best corrective measure alternative for cleaning up contamination at a site based on an evaluation of the RCRA Facility Investigation.

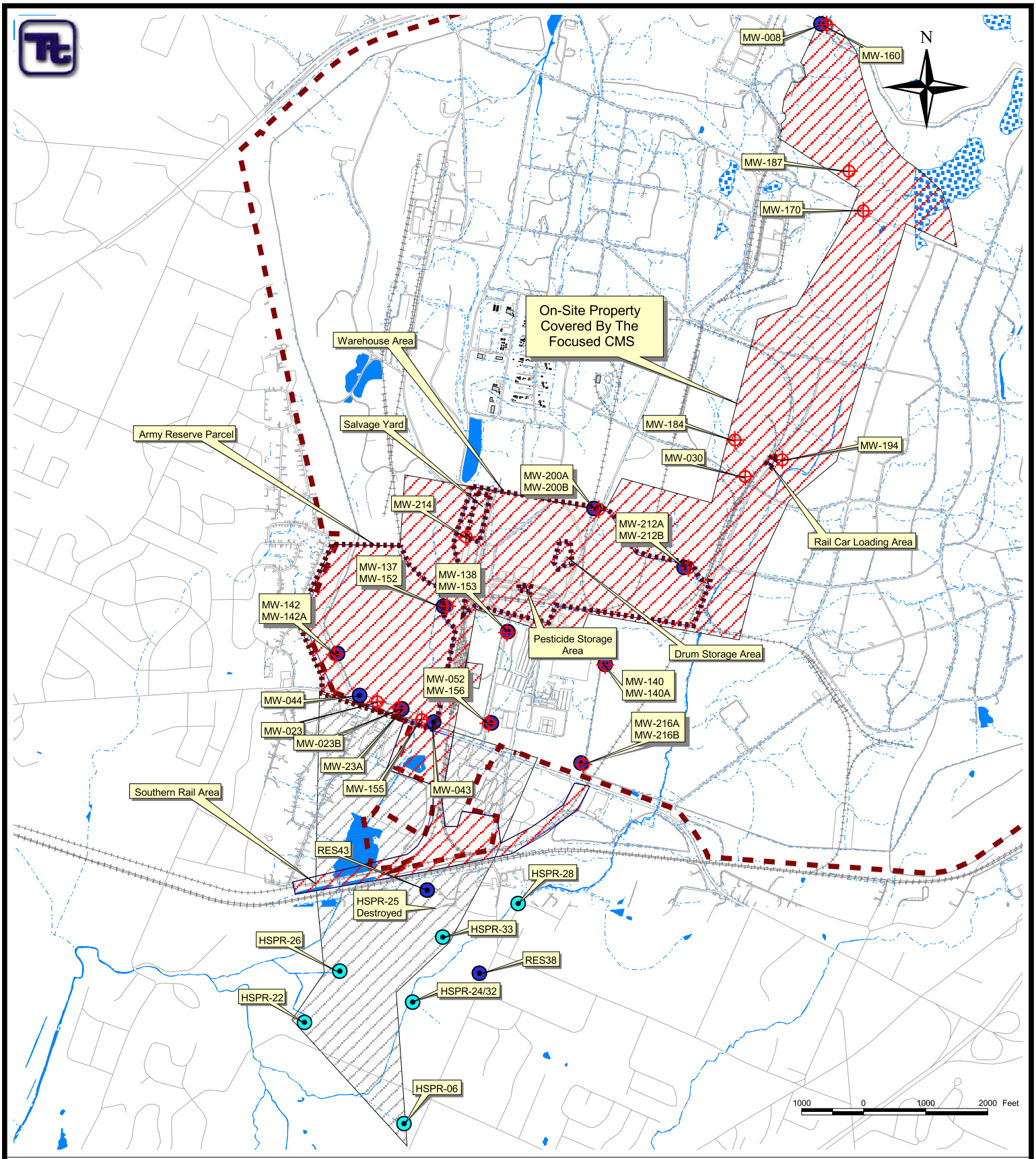
RCRA Facility Investigation – An investigation conducted under the requirements of RCRA to determine the nature and extent of contamination at a site, evaluate the risk of exposure to the contamination for human health and the environment, and estimate the fate and transport of the chemicals in nature.

Solid Waste Management Unit (SWMU) – Any discernible unit in which wastes have been placed at any time and from which contaminants may migrate. Units include but are not limited to old landfills, wastewater treatment tanks, container storage areas, surface impoundments, waste piles, land treatment units, incinerators, injection wells, recycling operations, leaking process or waste collection sewers, and transfer stations.

TNT – Trinitrotoluene, a nitroaromatic explosive compound manufactured at VOAAP.

Table 2 – Alternatives Comparison Analysis

Criteria	Alternative 1: No-Action	Alternative 2: Institutional Controls	Alternative 3: Institutional Controls and Monitored Natural Attenuation
Overall Protectiveness			
Human Health Protection	No reduction in risk.	Controls access to contaminated groundwater from onsite areas.	Institutional Controls ensure that no new wells are installed. Monitoring assesses the groundwater quality and will ensure the plume continues to degrade.
Environmental Protection	Does not monitor surface water.	Does not monitor surface water.	Ensures surface water remains protected.
Compliance with Regulatory Requirements			
RCRA	Permits exposure to groundwater exceeding cleanup objectives.	Prevents exposure to groundwater exceeding cleanup objectives.	Prevents exposure to ground-water exceeding cleanup objectives.
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risk	Existing risk will decrease with time.	Existing risk will decrease with time.	Existing risk will decrease with time.
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	Controls access to groundwater.	Controls access to groundwater.
Reduction of Toxicity, Mobility, or Volume through Treatment			
Treatment Process Used	None.	None.	None.
Type of Residuals Remaining after Treatment	Unmonitored natural biodegradation would eventually reduce contaminants to below cleanup objectives.	Unmonitored natural biodegradation would eventually reduce contaminants to below cleanup objectives. Controls will prevent access to groundwater.	Monitored natural biodegradation would eventually reduce contaminants to below cleanup objectives. Controls will prevent access to groundwater.
Short-Term Effectiveness			
Community Protection	No short-term risks to the community.	No short-term risks to the community.	No short-term risks to the community.
Worker Protection	No short-term risks to workers.	No short-term risks to workers.	Groundwater sampling workers would be protected from exposure to hazardous substances through appropriate use of personal protective equipment.
Environmental Impacts	No short-term risks to the environment.	No short-term risks to the environment.	No short-term risks to the environment.
Time until Action is Complete	No action.	Relatively short.	Relatively short. Monitoring program estimates approximately 30 years until criteria are reached.
Implementability			
Ability to Construct and Operate	No construction or operation.	No construction or operation.	Monitoring program underway and will continue for approximately 30 years.
Ease of doing More Action if Needed	Alternative does not preclude additional action.	Alternative does not preclude additional action.	Alternative does not preclude additional action.
Ability to Monitor Effectiveness	No monitoring required.	No monitoring required.	No significant issues.
Ability to Obtain approvals and Coordinate with Other Agencies	No-action is not protective, and therefore, is not approved by regulatory agencies.	Approval difficult. Groundwater monitoring needed for regulatory agencies to approve institutional controls.	No significant issues.
Availability of Equipment, Specialists, and Materials	None required.	None required.	Readily available.
Availability of Technologies	None required.	None required.	Readily available.
Cost			
Capital Cost	None.	$13,320	$18,760
Present Value of Annual Cost	None.	$3,000	$3000 - $25250
Total Present Value Cost	None.	$49,280	$178,235



Legend

Groundwater Monitoring Locations
- Bedrock Well
- Interface Well
- Residuum Well
- Spring

- Facility Boundary
- Roads
- Railroads

Structures
- Building
- Cemetary
- Demolished
- Group
- Tanks

- Intermittent
- Permanent
- Streams
- On-Site Property
- Off Site Monitoring Area
- Sites Within The Focused CMS Boundary

TETRA TECH, INC.

Figure 1
Area Covered By The Proposed Remedy

Groundwater Focused CMS Report
Volunteer Army Ammunition Plant
Chattanooga, TN